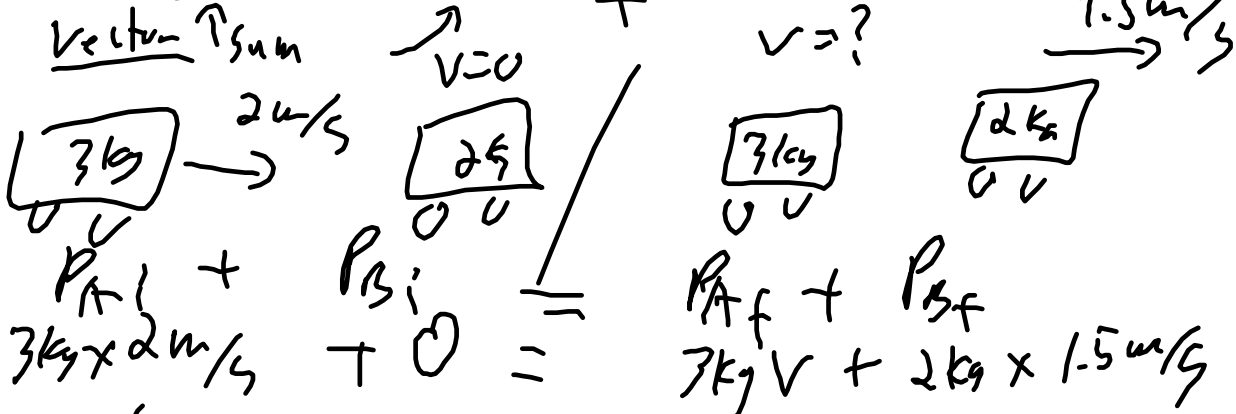
Quiz Tuesday Dec 13

eg. A 3.0 kg cart is moving at 2.0 m/s when it collides with a 2.0 kg cart.
What is the velocity of the 3.0 kg cart and the impulse on the cart after the collision if

a) the 2.0 kg cart was at rest before the collision and moving at 1.5 m/s after the collision.

$\sum P_i = \sum P_f$ if no friction or slipping

Vector sum



$\sum P$ $P_{A_i} + P_{B_i} = P_{A_f} + P_{B_f}$

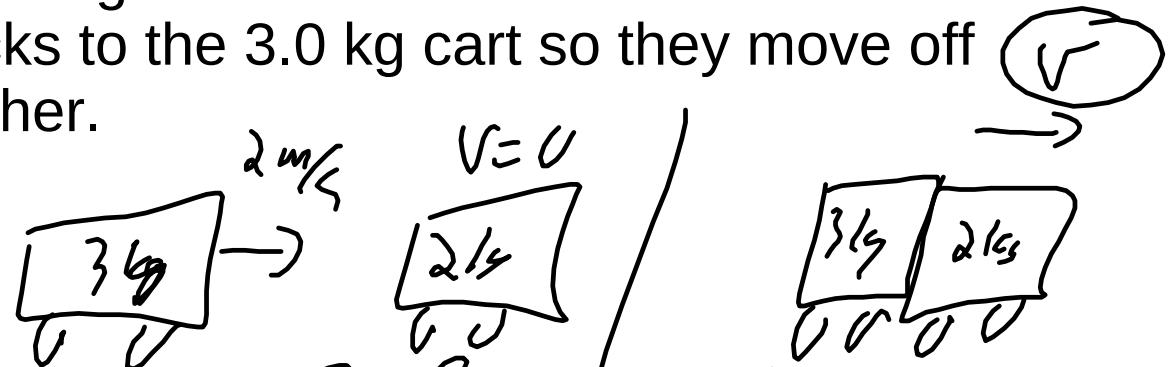
$3\text{kg} \times 2\text{m/s} + 0 = 3\text{kg}\,V + 2\text{kg} \times 1.5\text{m/s}$

$6\ \text{kg m/s} = 3\text{kg}\,V + 3\ \text{kg m/s}$

$3\ \text{kg m/s} = 3\text{kg}\,V$

$V = +1.0\ \text{m/s}$

b) the 2.0 kg cart was at rest before the collision and it sticks to the 3.0 kg cart so they move off together.



$\sum P_i = \sum P_f$

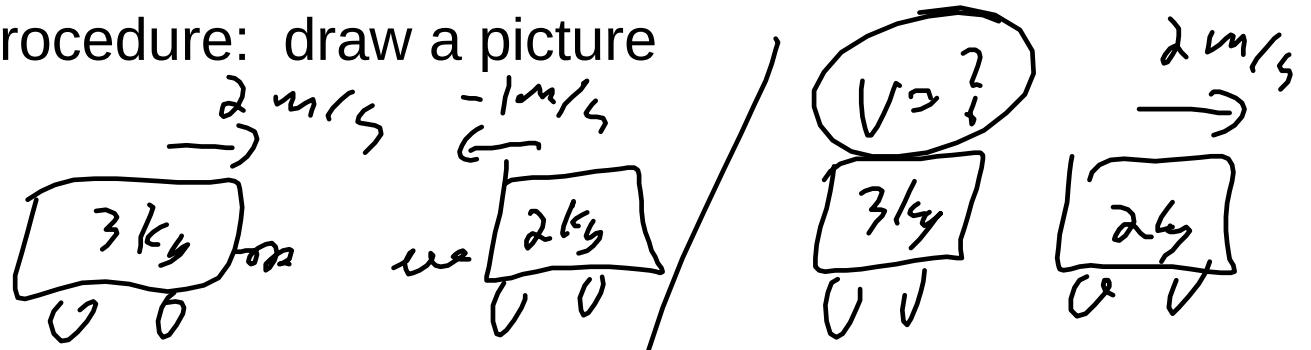
$(3+2)\text{kg} \times V$

$6.0\,kg\,m/s + 0 = (3+2)\,kg \times v$

$v = \frac{6}{(3+1)}\,m/s = \boxed{1.2\,m/s}$

a) the 2.0 kg cart was moving at -1.0 m/s before the collision and rebounds at +2.0 m/s after the collision.

procedure: draw a picture



$6\,kg\,m/s - 2\,kg\,m/s = 3\,kg\,v + 2\,kg \times 2\,m/s$

$4\,kg\,m/s = 3\,kg\,v + 4\,kg\,m/s$

$0 = 3\,kg\,v$ so $v = 0$

calculate the total momentum before the collision.
set up an equation with the momentum of all the objects after the collision.
Solve for your unknown velocity.
impulse is the change in momentum of the object

$\Delta p = p_f - p_i$

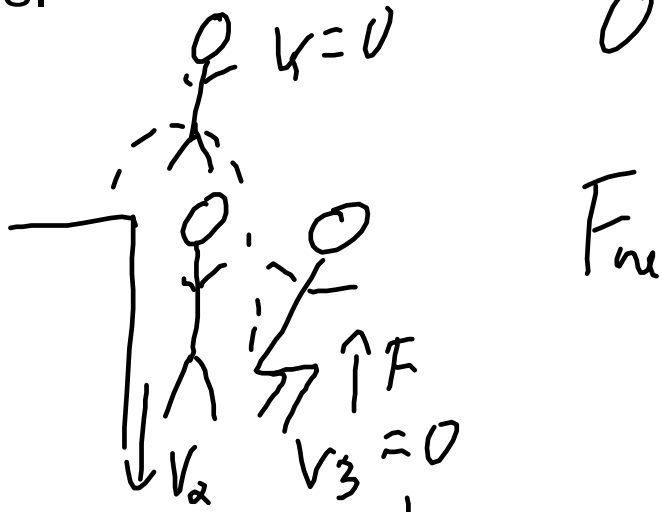
Δp of 3kg mass $= 0 - 6\,kg\,m/s$

Δp of 2 kg mass $= 4\ kg\,m/s - (-2\ kg\,m/s)$

$= +6\ kg\,m/s$

p180 CR 1.1 momentum is a vector quantity so direction matters.

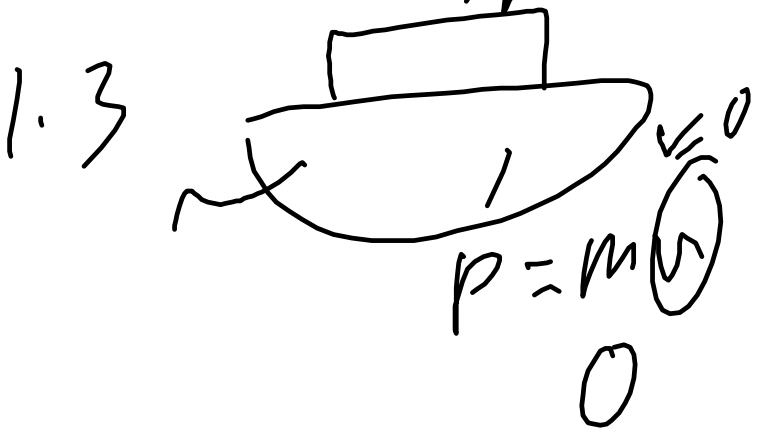
1.2

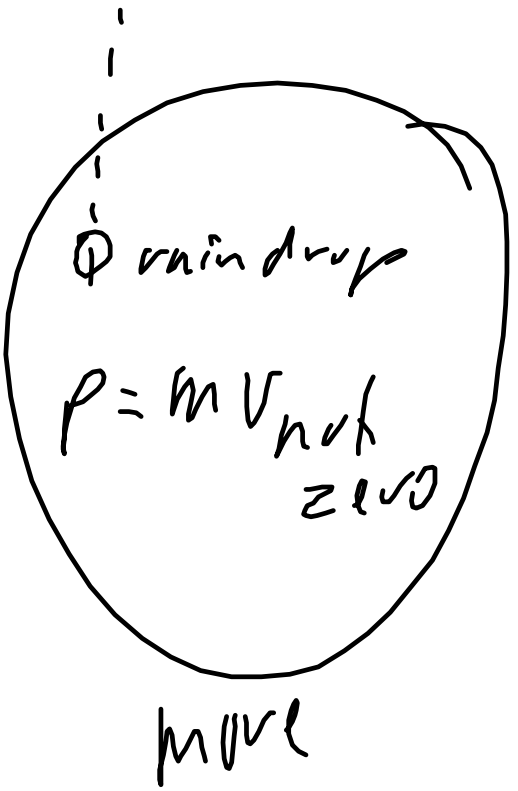


$0 - mv_0$

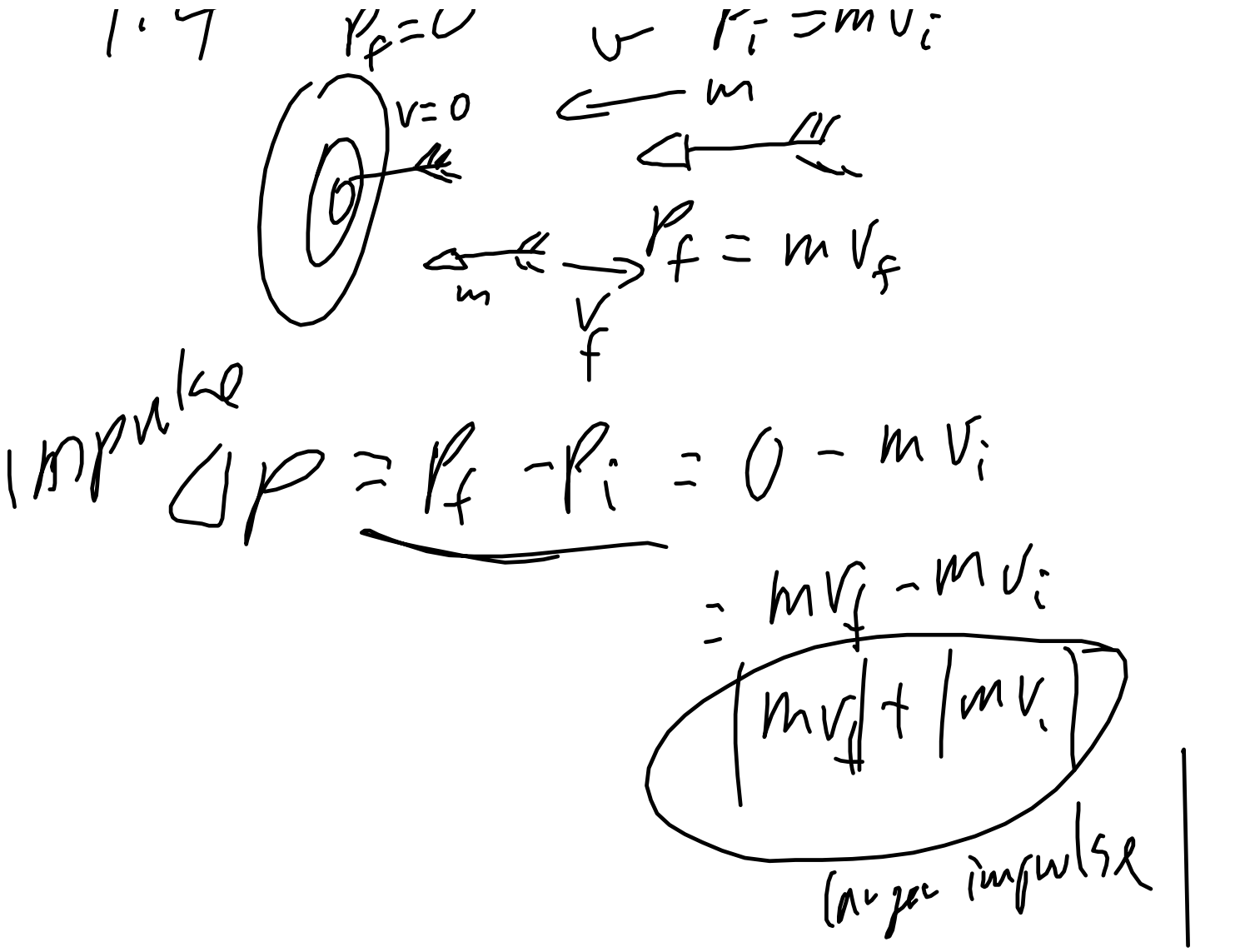
$F_{net} = \frac{\Delta p}{\Delta t}$ ← same ← large F small

1.3





1.4 $p_f = 0$ ∪ $p_i = mv_i$

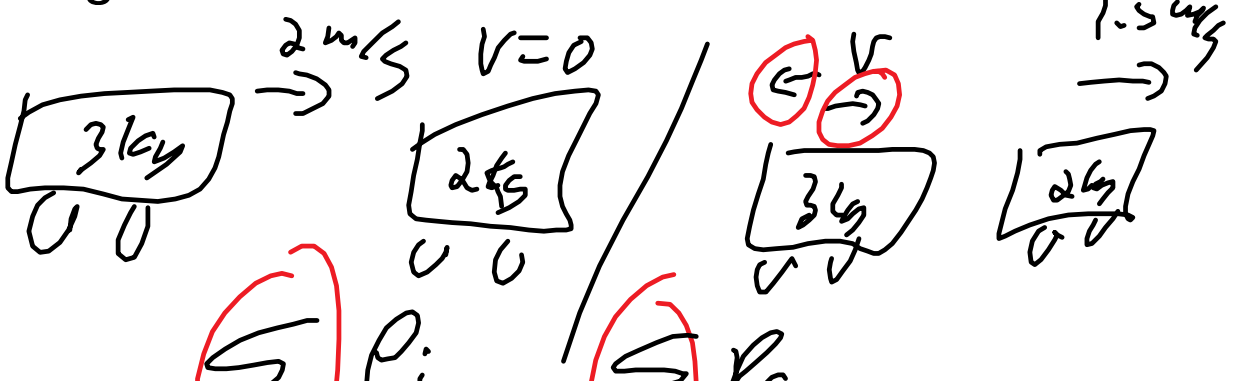


Block 1-2

eg. A 3.0 kg cart is moving at 2.0 m/s when it collides with a 2.0 kg cart.

What is the velocity of the 3.0 kg cart after the collision and the impulse on the cart during the collision if

a) the 2.0 kg cart was at rest before the collision and moving at 1.5 m/s after the collision.



$\sum p_i = \sum p_f$

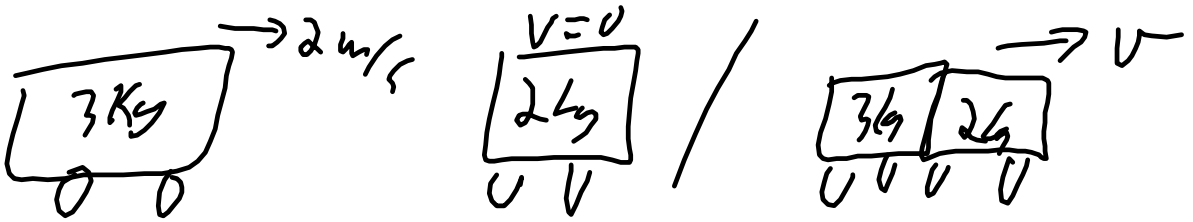
vector sum

$p_{Ai} + p_{Bi} = p_{Af} + p_{Bf}$

3.0kgx2.0m/s + 2kg x 0 = 3.0kg x v + 2.0kg x 1.5m/s
6.0kgm/s = 3.0 kg x v + 3.0 kg m/s
6.0 m/s - 3.0 m/s = 3.0 v
v=1.0 m/s

impulse = change in momentum = pf-pi
2kg mass =pf -pi = 3.0kgm/s - 0 = 3.0 kgm/s
3kg mass = pf-pi= 3.0 kgm/s - 6.0kgm/s = -3.0kgm/s

b) the 2.0 kg cart was at rest before the collision and it sticks to the 3.0 kg cart so they move off together.



$p_{Ai} + p_{Bi} = p_{Af} + p_{Bf}$

$3kg \times 2m/s + 2kg \times 0 = 3kgv + 2kgv$

$\frac{6kgm/s}{5} = \frac{5v}{5}$

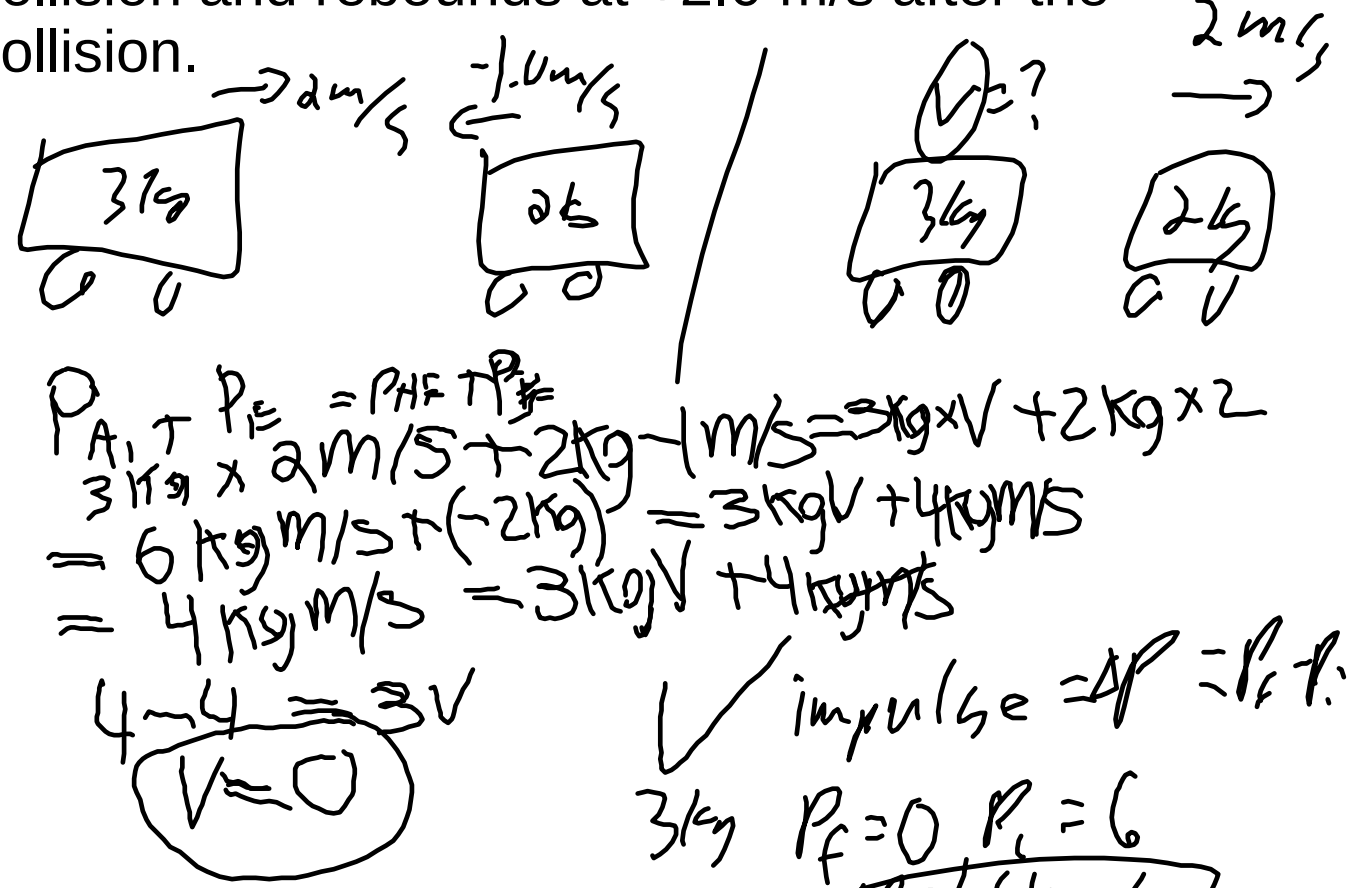
$1.2m/s = v$

$\Delta p_{2kg} = 2.4kgm/s$

$3kg: 3(1.2) - 6 = -2.4kgm/s$

a) the 2.0 kg cart was moving at -1.0 m/s before the

collision and rebounds at +2.0 m/s after the collision.



$P_{A,T} + P_{B,T} = P_{AF} + P_{BF}$

$3kg \times 2m/s + 2kg \times -1m/s = 3kg \times V + 2kg \times 2$

$= 6kgm/s + (-2kg) = 3kgV + 4kgm/s$

$= 4kgm/s = 3kgV + 4kgm/s$

$4 - 4 = 3V$

$V = 0$

impulse $= \Delta P = P_f - P_i$

3kg $P_f = 0$ $P_i = 6$

$\Delta P = -6 kgm/s$

2kg $P_f = 4 kgm/s$ $P_i = -2 kgm/s$

$\Delta P = 4 - (-2) = +6 kgm/s$

procedure: draw a picture
calculate the total momentum before the collision.
set up an equation with the momentum of all the objects after the collision.
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impulse is the change in momentum of the object